

# Fall 2010 Climate Summary For Southwest Lower Michigan

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## *Overview*

The fall of 2010 over Southwest Lower Michigan featured above normal temperatures. Precipitation was mostly below normal, but the area near and northeast of Lansing had near to above normal precipitation. Snowfall was well below normal across all of Southwest Lower Michigan for the second fall in a row (Table 1). The frequency of exceptionally warm days (highs of 80 degrees or warmer) and the frequency of exceptionally cold days (highs at or below freezing) were also below normal (Table 2). Severe storm activity was well above normal but mostly concentrated in the month of September. It is typical for September to be the most active severe storm month most fall seasons in Southwest Lower Michigan.

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**TABLE 1. Reported temperature and precipitation for the fall of 2010 at the primary climate stations in Southwest Lower Michigan. Normals are computed from 30 year averages from 1971-2000.**

Location		Average Temperature (degrees F)	Precipitation (inches)	Snowfall (inches)
Grand Rapids	<i>Reported</i>	52.7	8.22	0.1
	<i>Normal</i>	49.9	11.64	8.3
	<i>Departure</i>	+ 2.8	- 3.42	-8.2
	<i>Record Max Avg (year)</i>	57.4 (1931)		
	<i>Record Min Avg (year)</i>	45.8 (1976)		
	<i>Record Max (year)</i>	98 (1913)	18.11 (1911)	26.9 (1951)
	<i>Record Min (year)</i>	-10 (1950)	2.59 (1956)	0.0
Lansing	<i>Reported</i>	51.5	9.76	T
	<i>Normal</i>	49.2	8.43	5.5
	<i>Departure</i>	+2.3	+1.33	-5.5
	<i>Record Max Avg (year)</i>	55.1 (1931)		
	<i>Record Min Avg (year)</i>	41.5 (1869)		
	<i>Record Max (year)</i>	99 (1894)	14.98 (1990)	24.0(1869)
	<i>Record Min (year)</i>	-5 (1949)	2.05 (1956)	0.0
Muskegon	<i>Reported</i>	52.6	9.84	T
	<i>Normal</i>	49.6	8.67	9.3
	<i>Departure</i>	+ 3.0	+ 1.17	-9.3
	<i>Record Max Avg (year)</i>	56.9 (1931)		
	<i>Record Min Avg (year)</i>	45.8 (1976)		
	<i>Record Max (year)</i>	95 (1954, 1953)	17.29 (1988)	25.7(1995)
	<i>Record Min (year)</i>	-14 (1950)	2.91 (1956)	0.0

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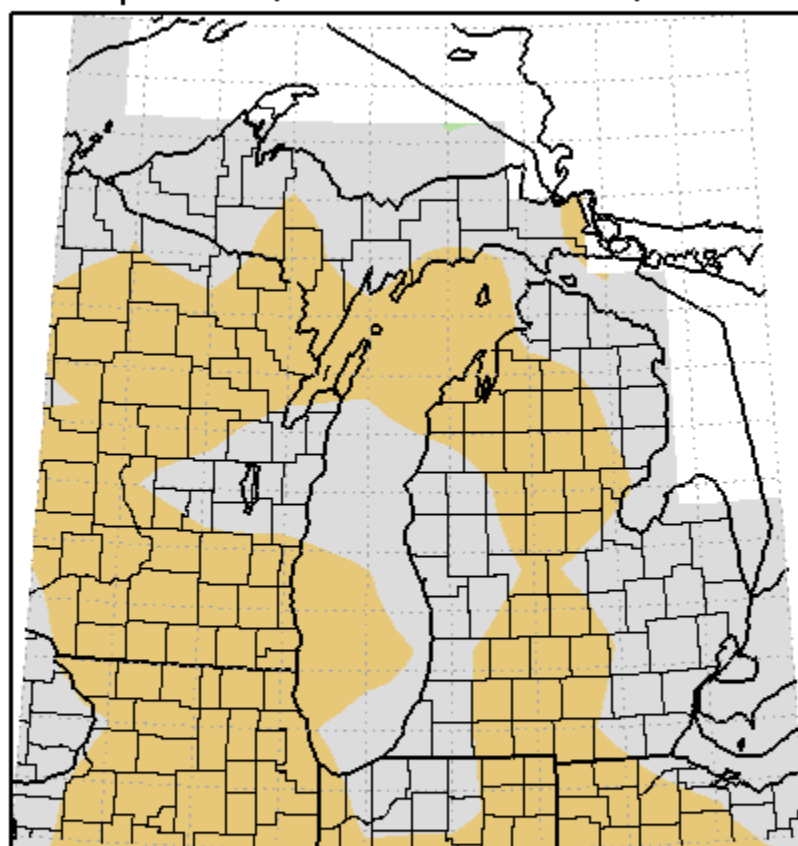
**Table 2. Fall 2010 temperature frequencies at the primary climate stations.**

<b>Number of days</b>	<b>Grand Rapids</b>	<b>Lansing</b>	<b>Muskegon</b>
<i>highs <math>\geq 80</math> (2010)</i>	6	6	3
<i>highs <math>\geq 80</math> (2009)</i>	5	2	7
<i>highs <math>\geq 80</math> (normal)</i>	7.2	7.8	6.0
<i>highs <math>\geq 80</math> (record)</i>	23	22	16
<i>year(s) of record</i>	1947	1920	1947
<i>highs <math>\leq 32</math> (2010)</i>	0	1	0
<i>highs <math>\leq 32</math> (2009)</i>	0	0	0
<i>highs <math>\leq 32</math> (normal)</i>	2.6	2.8	2.3
<i>highs <math>\leq 32</math> 0 (record)</i>	11	14	12
<i>year(s) of record</i>	1951	1951	1951
<i>lows <math>\leq 32</math> (2010)</i>	20	23	14
<i>lows <math>\leq 32</math> (2009)</i>	13	19	13
<i>lows <math>\leq 32</math> (normal)</i>	23.7	27.4	22.3
<i>lows <math>\leq 32</math> 0 (record)</i>	41	63	33
<i>year(s) of record</i>	1976	1976	1976
<i>lows <math>\geq 0</math> (2010)</i>	0	0	0
<i>lows <math>\geq 0</math> (2009)</i>	0	0	0
<i>lows <math>\geq 0</math> (normal)</i>	0	0	0
<i>lows <math>\geq 0</math> (record)</i>	4 (1943)	2 (1950)	2 (1950)

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Average Temperature Departure from Mean in Degrees F  
September 1, 2010 to November 30, 2010



Midwestern Regional Climate Center  
Illinois State Water Survey  
Champaign, Illinois

**Figure 1. The fall 2010 daily mean temperature departure from normal for Michigan.**

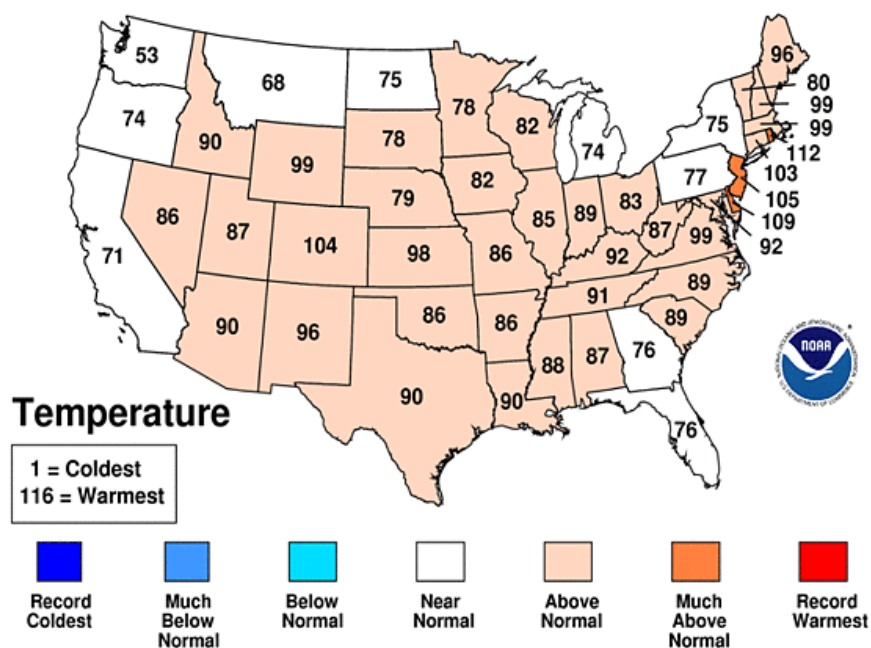
The areal averaged fall mean temperature was 50.9°F, which was 1.7°F warmer than the 1971 to 2000 normal. It was also 0.7 degrees warmer than the fall of 2009. Most of the western Great Lakes averaged above normal for the fall of 2010 (Fig. 1). Of the 24 reporting stations (Cooperative Observers) having complete datasets, only 2 were below normal while 16 were at least 1 degree above normal. The warmest reporting station that had all of the data for the entire month was Gulf Lake Bio Station, which had a mean of 54.0 degrees and was 5.0 degrees above normal. The coldest station was White Cloud with a mean of 47.0 degrees and that was 2.0 degrees below normal.

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While the summer of 2010 had an unusually high frequency of days with warm highs and lows, the fall of 2010 did not follow suit. The frequency of days with highs of 80 degrees or warmer was below normal at all three of our primary climate sites, with Muskegon having only half of their normal total (Table 2). Similar to the summer of 2010, however, the frequency of colder than normal temperatures remained suppressed. The frequency of cold spells (3 or more days in a row with the daily departure from normal 5 or more degrees below normal) remained below normal. There was only one cold spell in each of the seasons (winter, spring, summer and fall) for 2010. Normally, there would be eight in the winter, four in the spring, three in the summer, and four in the fall. This is the fewest number of cold spells since 1998, when there were two. Of the last 10 falls, 2010 was near the middle; five were colder than this fall and four were warmer. The warmest fall in Southwest Lower Michigan since records began in 1895 was the fall of 1931 with an areal mean of 55.2 degrees - a full 6.0 degrees warmer than normal. The coldest fall since records began was 1976, with a mean of 44.6 degrees, which is 4.6 degrees colder than normal.

## September-November 2010 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA

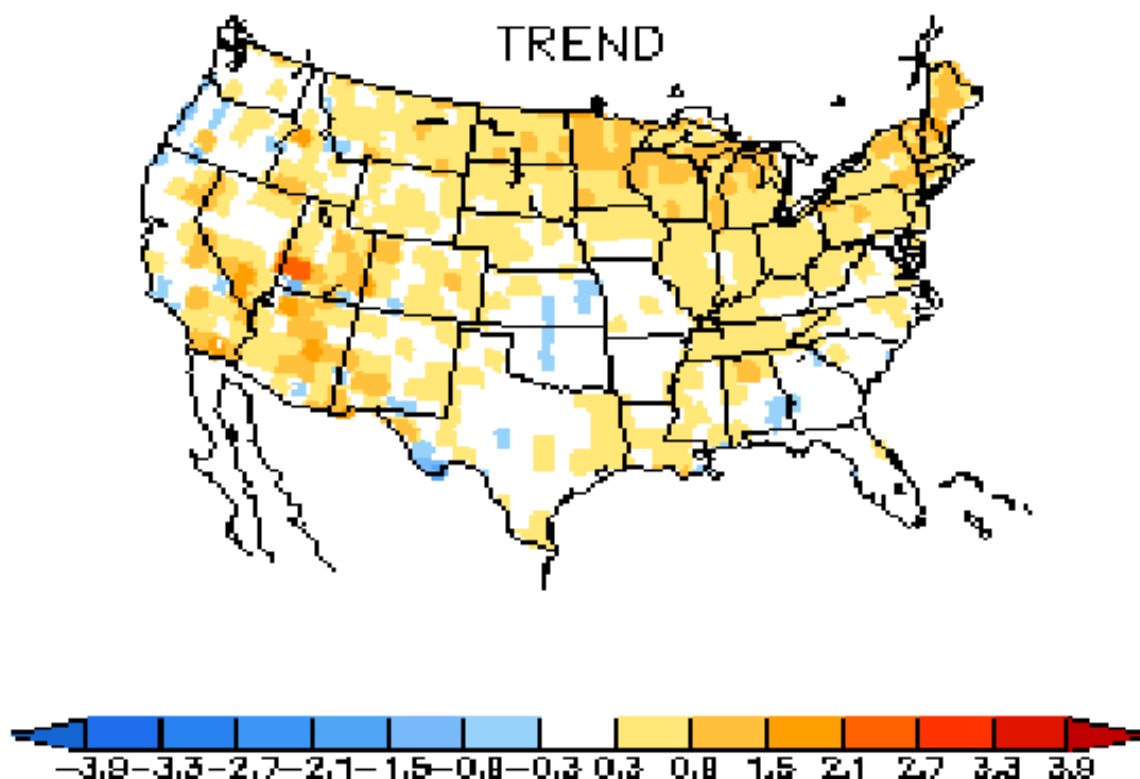


**Figure 2. The summer 2010 temperature ranking for the contiguous United States.**

For the state of Michigan, the fall of 2010 was the 71<sup>st</sup> coldest (46<sup>th</sup> warmest) out of 116 years of falls dating back to 1895 (Fig. 2). Equivalently, this fall was the 46th warmest.

# Fall 2010 Climate Summary For Southwest Lower Michigan

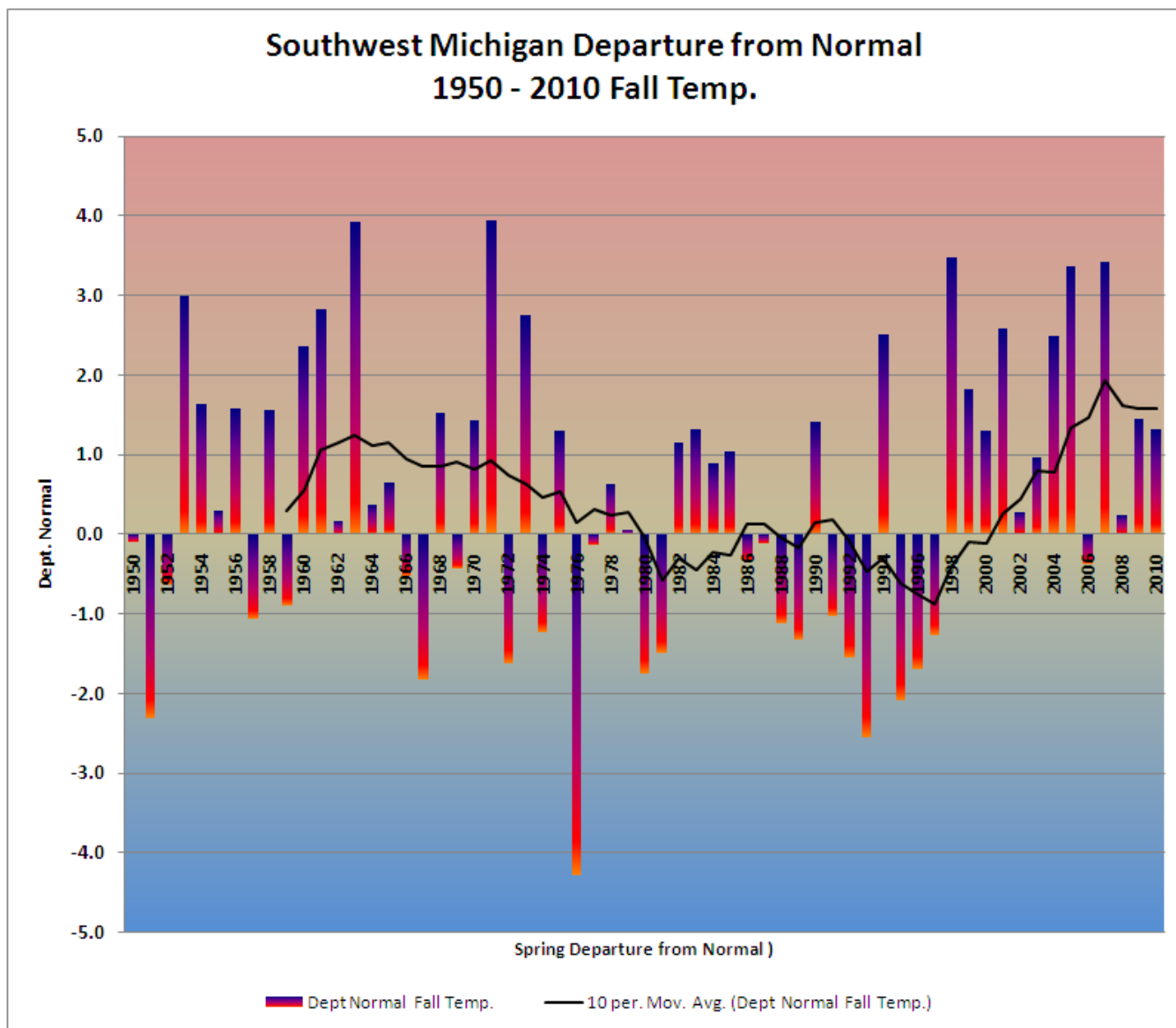
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**Figure 3. Fall (September-November) temperature trend. The trend is the mean temperature over the past ten years (2000-2009) minus the 1971-2000 mean.**

The Climate Prediction Center (CPC)'s trend analysis shows the trend over the past 10 years has been for warm falls (Fig. 3). The western lake shore areas of Southwest Lower Michigan show the strongest warming trend, near 1 degree Celsius (1.8 degrees Fahrenheit) over the past 10 years. The trend toward warmer falls is seen in the fall temperature graph for our 36 long-term climate stations from 1950 to 2010 (Fig. 4). The 10 year running mean temperature rose steadily between 1998 and 2007, and then leveled off since then. The 10 year running mean to 2000 averaged 49.1 degrees and it has since warmed to 50.8 degrees as of the fall of 2010, which is a 1.7 degree climb. The warmest 10 year mean on record is 51.1 degrees from 1998 through 2007, which is 0.3 warmer than the current mean.

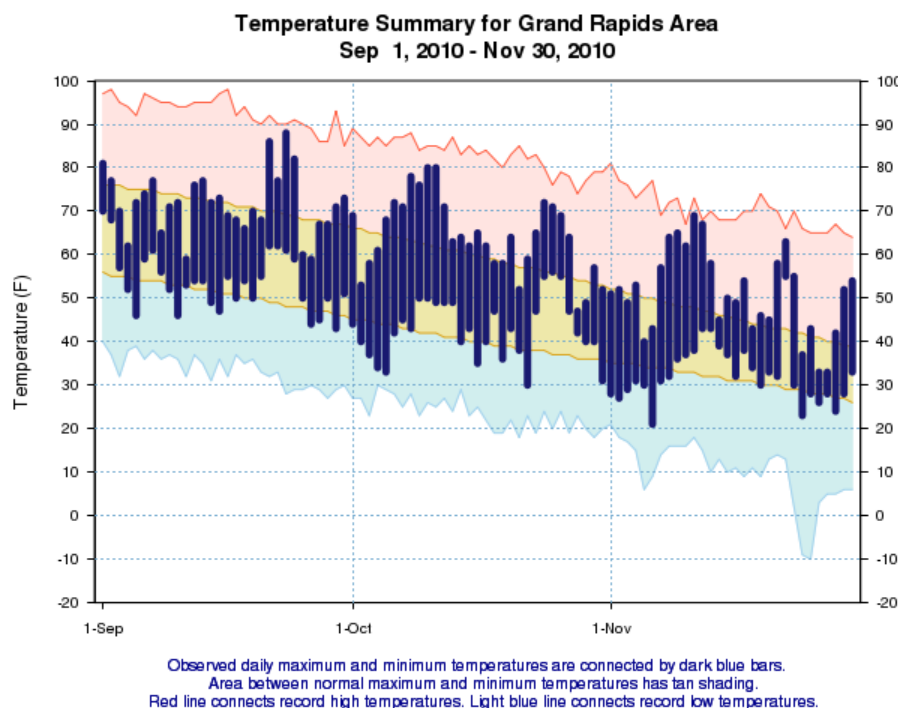
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**Figure 4. Fall mean temperature departure from normal for all of Southwest Lower Michigan from 1950 through 2010 using the 36 long-term climate stations.**

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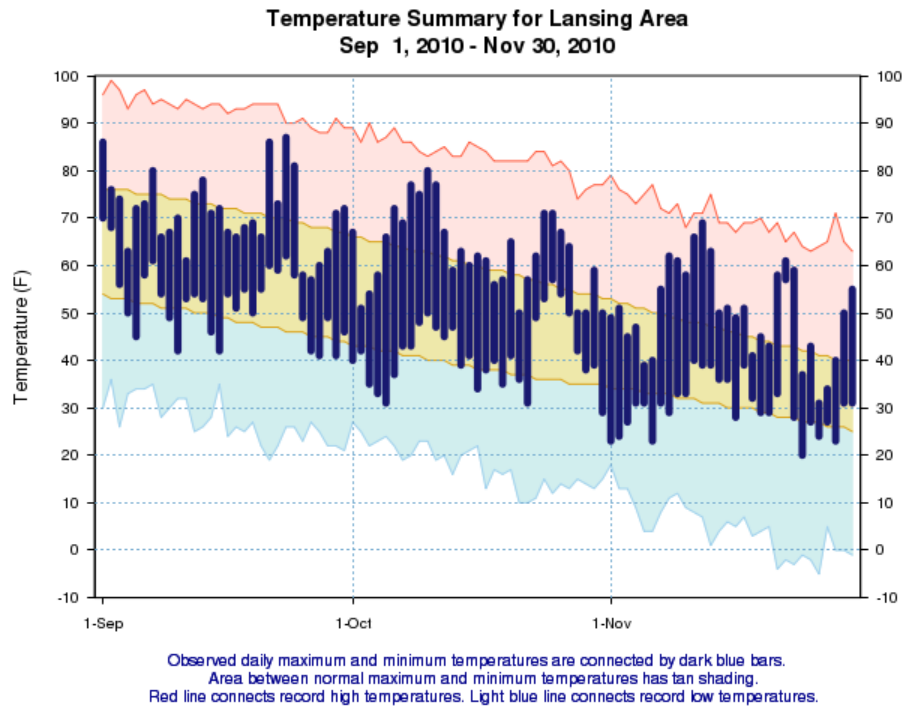
**Figure 5. Fall 2010 daily temperatures for Grand Rapids. Daily maximum and minimum temperatures are connected by dark blue bars. The area between the maximum and minimum normal temperatures has tan shading. Red lines connect the record high temperatures. Blue lines connect the record low temperatures.**

Figs. 5-7 show the daily temperatures were mostly above normal for this past fall. There were five prominent warm spells (3 or more consecutive days with the daily mean 5 or more degrees warmer than normal). The first warm spell began in the third week in September. There were two warm spells in October, one toward the beginning and the other toward the end of the month. The first warm spell in October was the longest of the fall, running for seven days from the 7<sup>th</sup> to the 13<sup>th</sup> and averaging 9 degrees above normal. The second warm spell in October lasted from the 23<sup>rd</sup> to the 27<sup>th</sup> (five days), but averaged 14 degrees above normal. There were two more warm spells in November. The most prominent warm spell was from the 8<sup>th</sup> through the 13<sup>th</sup> of November. During those 6 days, the daily mean temperature was 11 degrees warmer than normal. As was typical of the entire year, there were few cold spells in the fall. The only one was from the 2<sup>nd</sup> through the 4<sup>th</sup> of October when the mean temperature averaged 8 degrees below normal. Thus, for one more season in 2010, warm spells significantly outnumbered the cold spells in both frequency and length. These warm and cold spells can be seen on the charts for Grand Rapids (Fig. 5), Lansing (Fig. 6) and Muskegon (Fig. 7).

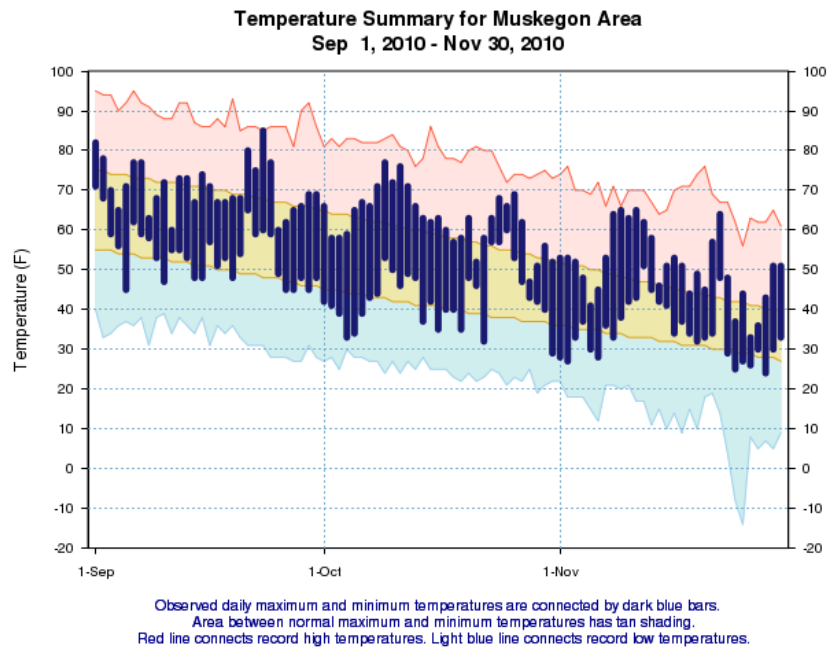


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**Figure 6. Same as Figure 5, expect for Lansing.**

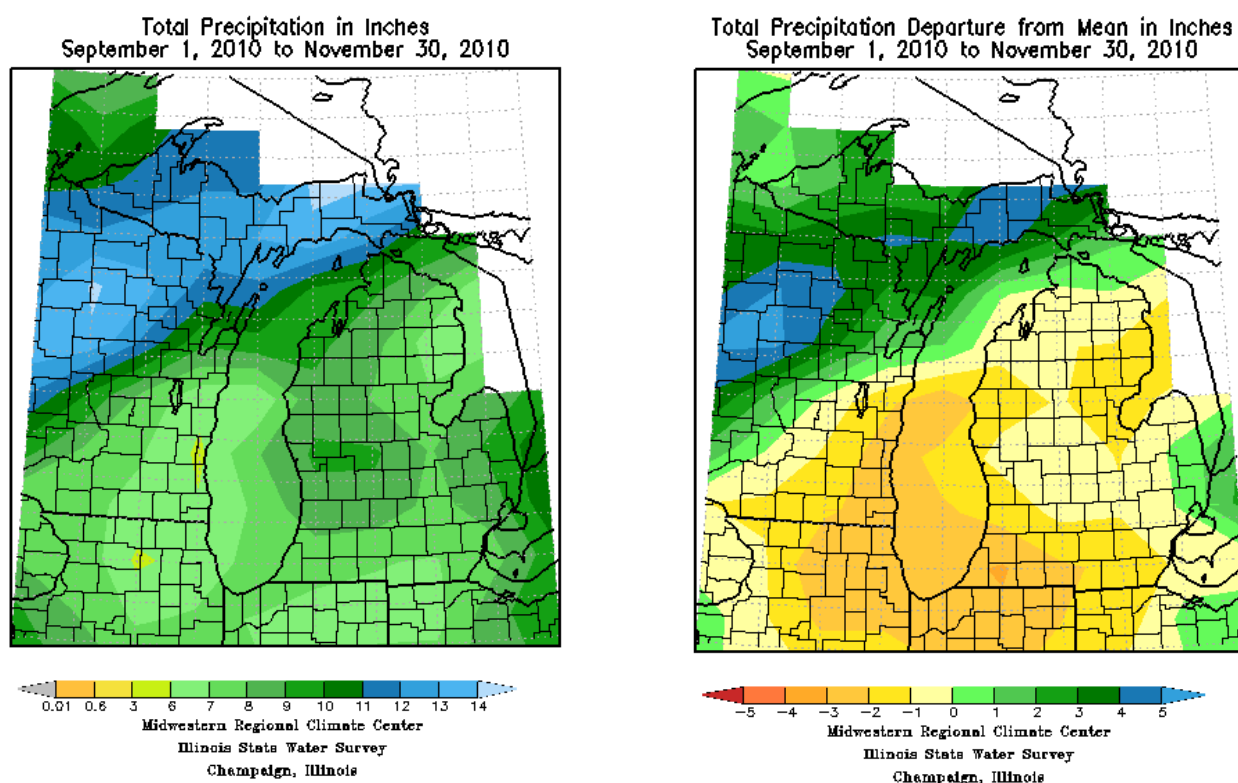


**Figure 7. Same as Fig. 5, expect for Muskegon.**

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## Fall Precipitation:

Most stations reported between 7 and 10 inches of rain (Figure 8A). Rainfall was, for the most part, below normal over Southwest Lower Michigan with the southwestern sections of the area recording precipitation around 2 inches below normal (Fig. 8B). The highest reported rainfall was 11.61 inches at the Fennville CoCoRaHS station. The lowest reported total was 3.69 inches at the Albion Cooperative Observer station. The areal mean is 9.48 inch, which is 1.66 inches below normal. The area between Lansing and Mount Pleasant had slightly above normal rainfall, with Mount Pleasant's 10.90 inches being 1.56 inches above normal. Meanwhile, the area with the least rainfall was along and south of I-94 near Jackson and southwest of Kalamazoo. There, rainfall totals were in the 3 to 4 inch range.



8A  
8B  
**Figure 7. Fall total precipitation (A) and departure from normal (B) for Michigan.**

The National Climate Center's Statewide Ranking Map (Fig. 9) put Michigan as 66th wettest, 58th being midway between wettest and driest. That would suggest Michigan overall had near normal rainfall for the fall of 2010. The Climate Predictions Center's Fall Trend Map (Fig. 10) shows a 15 year trend toward drier falls.

The 9.48 inches for the mean area rainfall, which was 1.66 inches below normal, does actually fall into the bottom one third driest of the past 116 years looking at just the Southwest Lower Michigan part of the state. Looking at the local rainfall trend since the fall of 1995 (Fig. 11), it can be seen there is

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a clear trend toward drier falls. Since 1995, there were seven falls that were drier than normal, four falls that were wetter than normal, and four that were near normal.

## September-November 2010 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA

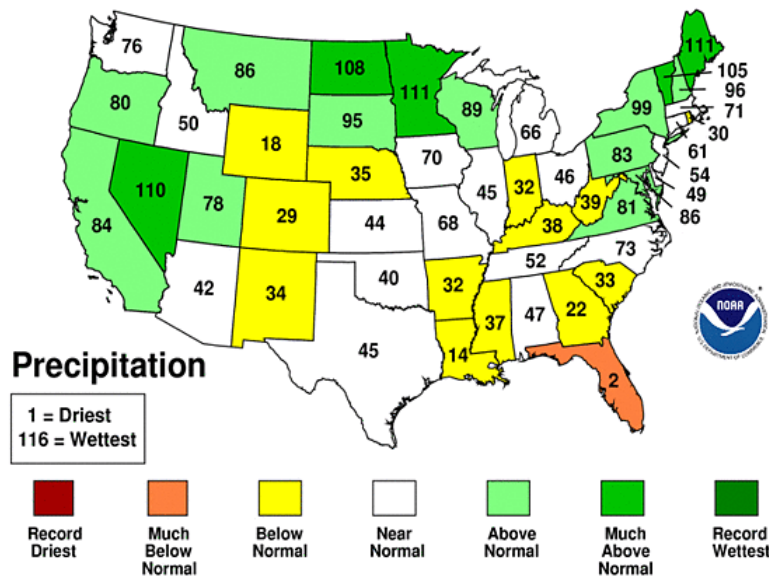


Figure 8. The NCDC fall precipitation ranking for the contiguous United States.

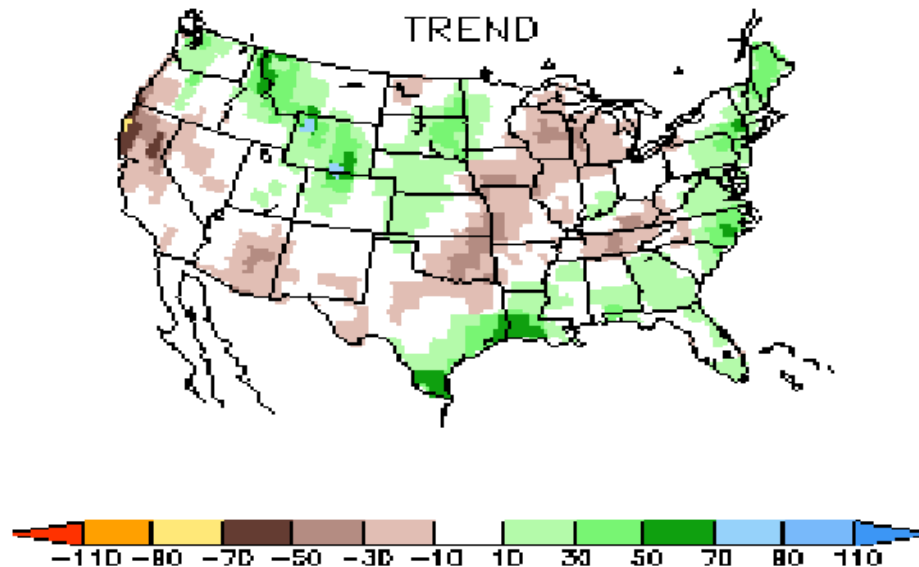
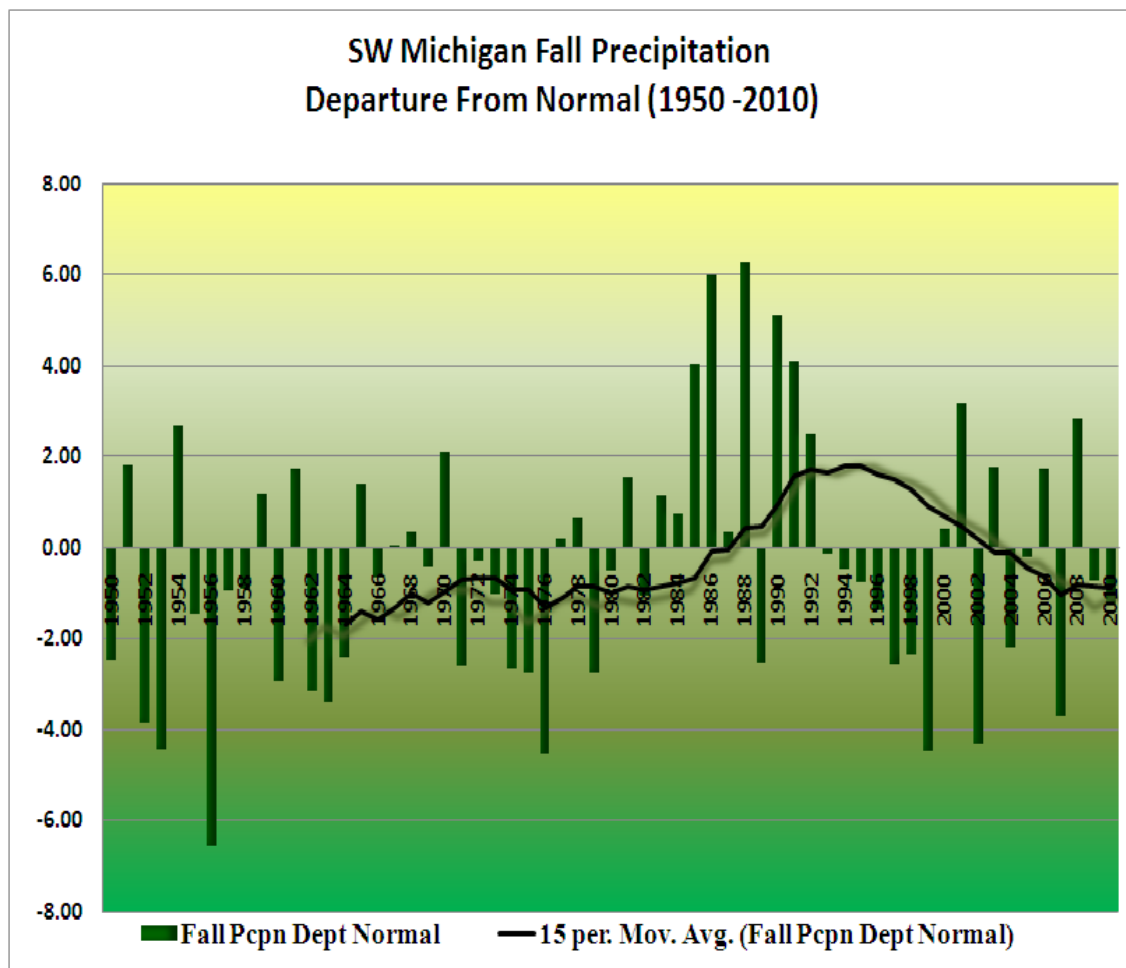


Figure 9. Summer precipitation trend.

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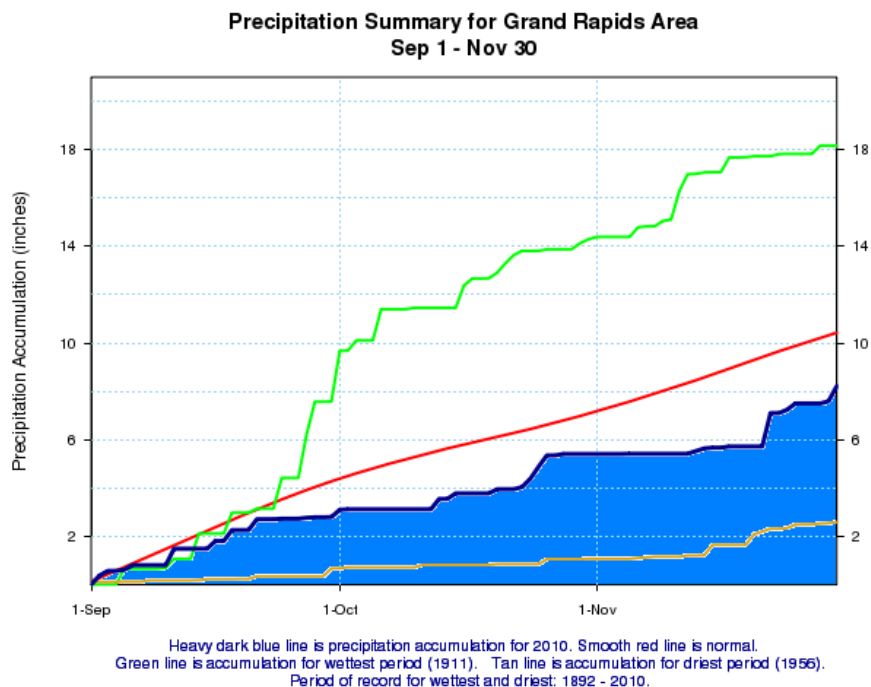


**Figure 10. Total fall precipitation departure from normal for all of Southwest Lower Michigan from 1950 through 2009 using the 36 long-term climate stations.**

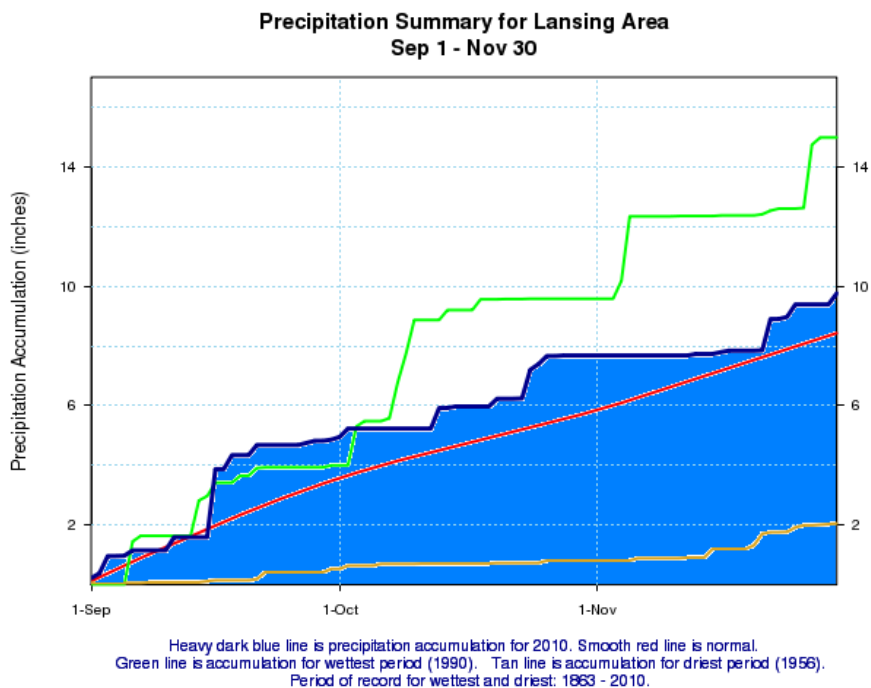
Each of the fall months at Grand Rapids contributed about 2.5 inches of precipitation (Fig. 12). No month was significantly wetter than the other. September normally is the wettest fall month, with an average around 4 inches. Thanks to a daily record breaking 2.28 inches of rain in Lansing on the 16th, September recorded over 4 inches of rain, making it the wettest month (Fig. 14). At Muskegon (Fig. 14), there was a record breaking 3.32 inches of rain on the 2nd of September. That brought the September total to 6.25 inches. October had around 2 inches of rain, like Grand Rapids and Lansing. However, November was rather dry with only 1 ½ inches of rain.

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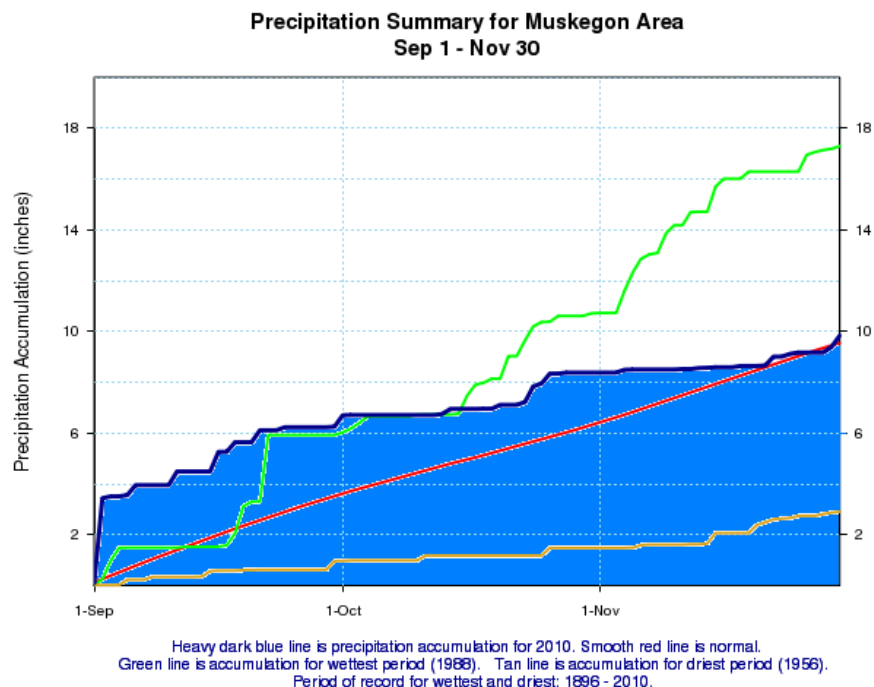
**Figure 11. Grand Rapids daily precipitation accumulation for the summer of 2010.**



**Figure 12. Lansing daily precipitation accumulation for the summer of 2010.**

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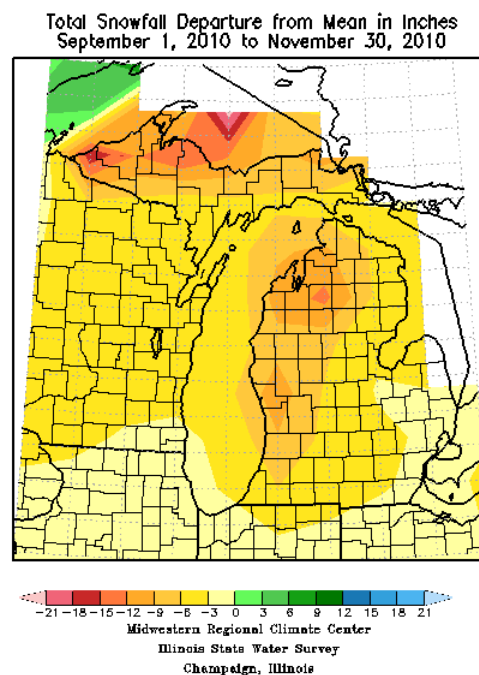
**Figure 13. Muskegon daily precipitation accumulation for the summer of 2010.**

## Fall Snowfall:

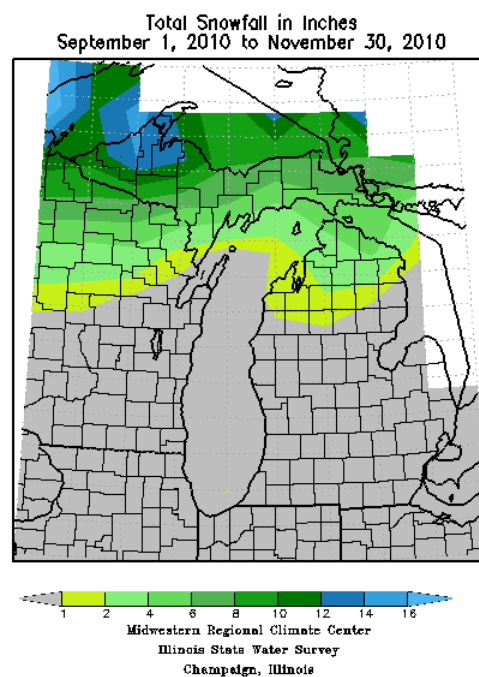
Fall snowfall was well below normal across all of Southwest Lower Michigan (Fig. 15). Really, there was no snow anywhere in Southwest Lower Michigan during the fall of 2010. In the typical lake effect snow areas, snowfall amounts were between 10 inches and 12 inches below normal. Even places away from the lake were 6 to 8 inches below normal in snowfall. The total snowfall for the fall of 2010 was zero inches (Fig. 16).

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**Figure 14. Snowfall departure from normal for the fall of 2010.**



**Figure 156. Snowfall total for the fall of 2010.**

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## **Severe Storms:**

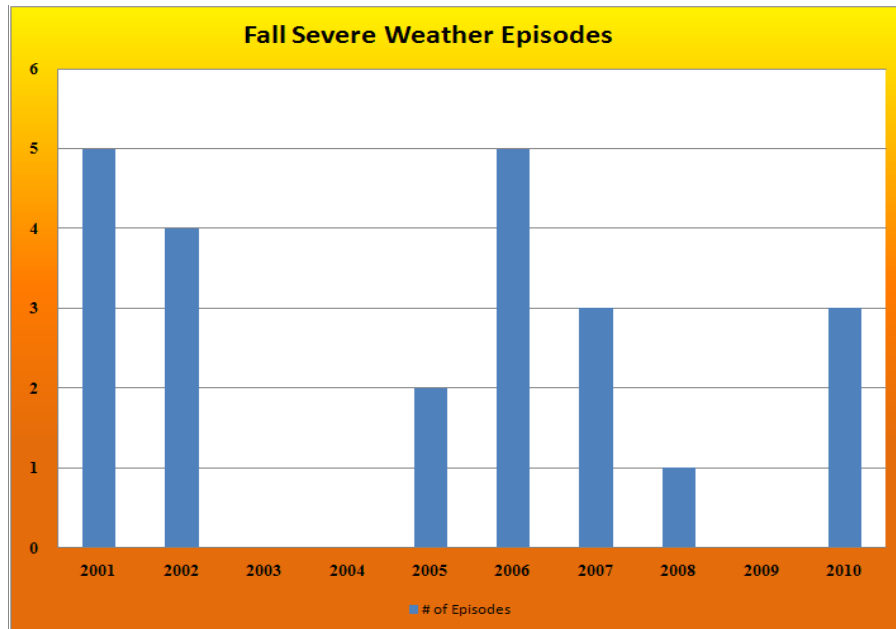
The fall of 2010 featured three severe storm episodes (3 or more severe weather events in a 6 hour period; Fig. 17), and 54 events (Fig. 18). This is greater than the normal numbers of 2 episodes and 26 events. The first episode occurred on the 3rd of September and consisted of 16 severe weather reports. The next episode on the 21st of September had 35 severe storm reports. The final severe episode for the fall of 2010 was on the 26th of October with only 3 events reported.

There have only been three other years with a severe weather episode featuring more events than the 35 on September 21st. The record number is 52 during the episode of June 17th, 1992. The record number of episodes is 5 set in both 2001 and 2006. The count of 54 events currently stands as the second highest number of severe storm events in our County Warning Area for any fall, with records going back to 1985. The record is 85 events set in the fall of 2007.

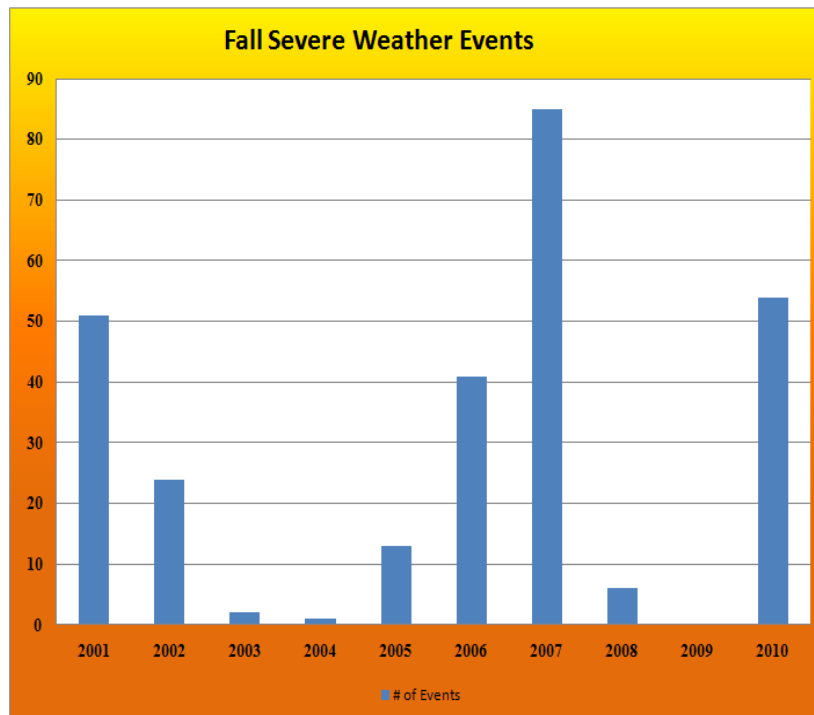


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**Figure 17. Fall severe weather episode total from 2001 through 2010.**



**Figure 18. Fall severe weather events total from 2001 through 2010.**

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For more details on the individual precipitation events, see the monthly weather summaries listed below:

**September 2010 Climate Summary** .....<http://www.crh.noaa.gov/images/grr/climate/CS201009.pdf>

**October 2010 Climate Summary** .....<http://www.crh.noaa.gov/images/grr/climate/CS201010.pdf>

**November 2010 Climate Summary**.....<http://www.crh.noaa.gov/images/grr/climate/CS201011.pdf>